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TRANSMITTAL LETTER TO THE UNITED STATES
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ATTORNEY'S DOCKET NUMBER

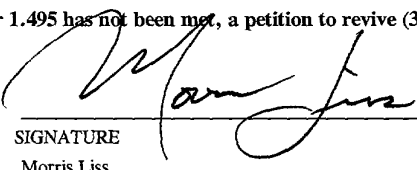
1854/00019

U.S. APPLICATION NO. (If known, see 37 CFR 1.5)

097857611

INTERNATIONAL APPLICATION NO. PCT/AU99/01101	INTERNATIONAL FILING DATE 13 December 1998- ¹⁹⁹⁹ BAK	PRIORITY DATE CLAIMED 14 December 1998
TITLE OF INVENTION BIODEGRADABLE POLYMER		
APPLICANT(S) FOR DO/EO/US LOUISE COOMBS, Stephen, CHRISTIE, Gregor Bruce Yeo		
<p>Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:</p> <ol style="list-style-type: none"> <input checked="" type="checkbox"/> This is a FIRST submission of items concerning a filing under 35 U.S.C. 371 <input type="checkbox"/> This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. § 371. <input checked="" type="checkbox"/> This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1). <input checked="" type="checkbox"/> A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date. <input checked="" type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371(c)(2)) <ol style="list-style-type: none"> <input checked="" type="checkbox"/> is transmitted herewith (required only if not transmitted by the International Bureau). <input type="checkbox"/> has been transmitted by the International Bureau. <input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US). <input type="checkbox"/> A translation of the International Application into English (35 U.S.C. 371(c)(2)). <input type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)) <ol style="list-style-type: none"> <input type="checkbox"/> are transmitted herewith (required only if not transmitted by the International Bureau). <input type="checkbox"/> have been transmitted by the International Bureau. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired. <input type="checkbox"/> have not been made and will not be made. <input type="checkbox"/> A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)). <input checked="" type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)). <input type="checkbox"/> A translation of the Annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)). <p>Items 11. to 16. below concern other document(s) or information included:</p> <ol style="list-style-type: none"> <input type="checkbox"/> An Information Disclosure Statement under 37 CFR 1.97 and 1.98. <input checked="" type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included. <input checked="" type="checkbox"/> A FIRST preliminary amendment. <input type="checkbox"/> A SECOND or SUBSEQUENT preliminary amendment. <input type="checkbox"/> A substitute specification. <input type="checkbox"/> A change of power of attorney and/or address letter <input checked="" type="checkbox"/> Other items or information: <p>Copy of the International Search Report; copy of the International Preliminary Examination Report; copy of PCT/IB/304 and PCT/IB/308</p>		

RECEIVED JUN 11 2001

U.S. APPLICATION NO. (If known, see 37 CFR 1.5) 03/85761		INTERNATIONAL APPLICATION NO. PCT/AU99/01101		ATTORNEY'S DOCKET NUMBER 1854/00019	
<input checked="" type="checkbox"/> The following fees are submitted: Basic National Fee (37 CFR 1.492(a)(1)-(5)): Search Report has been prepared by the EPO or JPO.....\$860.00 International preliminary examination fee paid to USPTO (37 CFR 1.482)\$690.00 No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)).....\$710.00 Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO.....\$1,000.00 International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4).....\$100.00				CALCULATIONS	PTO USE ONLY
ENTER APPROPRIATE BASIC FEE AMOUNT =				\$1,000.00	
Surcharge of \$130.00 for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(e)).				\$0.00	
Claims	Number Filed	Number Extra	Rate		
Total Claims	11 - 20 =	0	X \$18.00	\$0.00	
Independent Claims	2 - 3 =	0	X \$80.00	\$0.00	
Multiple dependent claim(s)(if applicable)			+ \$270.00	\$0.00	
TOTAL OF ABOVE CALCULATIONS =				\$1,000.00	
Reduction by 1/2 for filing by small entity, if applicable.				\$0.00	
SUBTOTAL =				\$1,000.00	
Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(e)).				\$0.00	
TOTAL NATIONAL FEE =				\$1,000.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property +				\$40.00	
TOTAL FEES ENCLOSED =				\$1,040.00	
				Amount to be: refunded \$	
				charged \$	
a. <input checked="" type="checkbox"/> A check in the amount of \$1,040.00 to cover the above fees is enclosed. b. <input type="checkbox"/> Please charge my Deposit Account No. <u>22-0185</u> in the amount of \$_____ to cover the above fees. A duplicate copy of this sheet is enclosed. c. <input checked="" type="checkbox"/> The Director is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. <u>22-0185</u> . A duplicate copy of this sheet is enclosed.					
NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b) must be filed and granted to restore the application to pending status SEND ALL CORRESPONDENCE TO: Connolly Bove Lodge & Hutz LLP 1990 M Street, N.W., Suite 800 Washington, DC 20036-3425					
				SIGNATURE  NAME Morris Liss 24,510 REGISTRATION NUMBER	

F06090 T19F5000

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	:	
	:	
Yu Long et al.	:	
	:	
Serial No.: To be assigned	:	Art Unit: To be assigned
	:	
Filed: Herewith	:	Examiner: To be assigned
	:	
For: BIODEGRADABLE	:	Atty Docket: 1854/00019
POLYMER	:	
	:	
	:	
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PRELIMINARY AMENDMENT

Commissioner for Patents
Washington, D.C. 20231

Sir:

Prior to initial examination, please amend the above-captioned case as follows.

IN THE ABSTRACT

Please add the Abstract of the Disclosure attached hereto on a separate sheet.

IN THE CLAIMS

Please add new claim 11 and amend claim 3 to read as follows:

3. (Amended) A composition as claimed in claim 1 wherein component c) is a polyvinyl alcohol component.

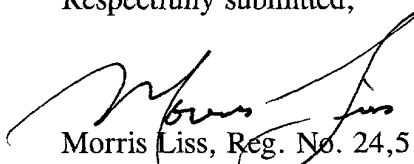
11. (Amended) A composition as claimed in claim 2 wherein component c) is a polyvinyl alcohol component.

REMARKS

Claims 1-11 are pending in this application.

Claim 3 has been amended to eliminate its multiple dependency and claim 11 has been added which is the recitation of claim 3 dependent from claim 2. None of these amendments is believed to involve any new matter. Accordingly, it is respectfully requested that the foregoing amendments be entered, that the application as so amended receive an examination on the merits, and that the claims as now presented receive an early allowance.

Respectfully submitted,



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Date: 6/8/01

Abstract Of The Disclosure

A biodegradable polymer having the composition from 8 to 80% by weight of a starch modified to include an hydroxalkyl C₂₋₆ group or modified by reaction with an anhydride for a dicarboxylic acid, preferably hydroxypropylated high amylose starch, from 0 to 87.9% of starch, from 4 to 11% by weight of a water soluble polymer selected from polyvinylacetate, polyvinyl alcohol and copolymers of ethylene and vinylalcohol which have a melting point compatible with the molten state of the starch components, from 0 to 20% by weight of a polyol plasticizer, preferably glycol, from 0.1 to 1.5% by weight of a C₁₂₋₂₂ fatty acid or salt, preferably stearic acid, and 0 to 12% added water. The polymers are suitable as biodegradable rigid sheet or flexible film materials for use in packaging foodstuffs.

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AMENDMENTS TO THE CLAIMS

3. (Amended) A composition as claimed in claim 1 [or claim 2] wherein component c) is a polyvinyl alcohol component.

09/857611

Biodegradable Polymer

This invention relates to improvements in biodegradable polymeric products particularly starch based polymers.

5

Background to the invention

There is an increasing demand for many plastic products used in packaging to be biodegradable. Trays in biscuit and chocolate packages are one example.

Starch films have been proposed as biodegradable alternatives for some time.

10 USA patent 3949145 proposed a starch/polyvinyl alcohol/glycerol composition for use as a biodegradable agricultural mulch sheet.

Difficulties have been encountered in producing starch based polymers particularly by hot melt extrusion. The molecular structure of the starch is adversely affected by the shear stresses and temperature conditions needed to plasticise the starch and pass it through the extrusion die. For most products foaming has to be avoided and this generally requires attention because of the water content of the starch. Foaming has been avoided by degassing the melt prior to exiting the die as suggested in USA patents 5314754 and 5316578. The latter patent also avoids adding water to the starch. As explained in USA patent 5569692 by not drying
15 starch and avoiding the addition of water the starch can be processed at temperatures between 120°C and 170 °C because the water bound to the starch does not generate a vapour pressure such as to require high pressures.

Another approach to improving the melt processability of starch is to provide an additive as in USA patent 5362777 which reduces the melting point of the starch.

25 The additive is selected from dimethyl sulfoxide, a selection of polyols and amino or amide compounds.

In order to produce starch polymers for particular applications they have been blended with a range of other polymers. Biodegradable blown films are disclosed in USA patent 5322866 which blends raw starch, polyvinyl alcohol and talc with
30 glycerol and water. USA patent 5449708 discloses compositions of starch ethylene acrylic acid and a salt of stearic acid plus a glycerol based lubricant. Flexible and clear transparent sheets are disclosed in USA patent 5374304. These are composed of a high amylose starch and a glycerol plasticizer. The use of starch in

conjunction with high amylose or modified starches has also been proposed. USA patents 5314754, and 5316578 both suggest the use of modified starches including hydroxypropyl substituted starches. Hydroxypropylation reportedly increases elongation at break and burst strength and improved resilience in the polymers. Although the efficacy of these special and modified starches is recognised, their cost inhibits the commercial acceptability of the products made from them.

It is an object of this invention to provide a biodegradable polymer which can be processed and thermoformed into sheet and shaped products without difficulty and have acceptable properties for its intended uses.

Brief Description of the Invention

To this end the present invention provides a process for forming biodegradable polymers which includes the steps of

- a) forming a mixture of starch, a modified starch, a water soluble polymer or copolymer containing vinyl alcohol units, up to 20 % of added water or a polyol plasticizer and 0.4 to 1.5 % by weight of a C₁₂₋₂₂ fatty acid or salt,
- b) working the mixture and forming a melt within the temperature range of 130°C to 160 °C
- c) reducing the temperature and further working the mixture and the extruding the mixture or injecting the mixture into a mould at a temperature of 85 °C to 105 °C without the need to remove water.

The process as defined allows starch based mixtures to be extruded without foaming. The need to vent the extruder to remove water prior to the mix exiting the extrusion die is not needed. Both rigid sheet and flexible starch based films can be made using this process. The foaming temperature of the mix is raised above the temperature at which the melt is most easily plasticised and extruded.

In another aspect, the present invention provides a biodegradable polymer having the composition

- a) from 8 to 80% by weight of a starch modified to include an
5 hydroxyalkyl C₂₋₆ group or modified by reaction with an anhydride of a dicarboxylic acid
- b) from 0 to 87.9% of starch
- c) from 4 to 11% by weight of a water soluble polymer selected from
polyvinylacetate, polyvinyl alcohol and copolymers of ethylene and vinylalcohol
10 which have a melting point compatible with the molten state of the starch components
- d) from 0 to 20% by weight of a polyol plasticiser
- e) from 0.1 to 1.5 % by weight of a C₁₂₋₂₂ fatty acid or salt and
- f) from 0 to 12 % by weight of added water.

15 The compositions defined include formulations suitable for forming films or thermoforming rigid products such as packaging trays. The defined compositions are easier to process as they can be extruded in film or sheet form without foaming. The extruded sheet can be thermoformed into shaped trays or containers
20 for use as biodegradable packaging. Usually the need to vent the extruder to remove water prior to the mix exiting the extrusion die is not needed with these formulations.

The upper limit to the content of the modified starch is determined by its cost. This component contributes structural benefits to the resulting material. A preferred
25 component is hydroxypropylated amylose. Other substituents can be hydroxyethyl or hydroxybutyl to form hydroxyether substitutions, or anhydrides such as maleic phthalic or octenyl succinic anhydride can be used to produce ester derivatives. The degree of substitution[the average number of hydroxyl groups in a unit that are substituted] is preferably 0.05 to 2. The preferred starch is a high amylose
30 maize starch. A preferred component is a hydroxypropylated high amylose starch A939 marketed by Goodman Fielder. A preferred concentration range to meet cost parameters for biscuit trays is 12 to 24 %.

The other starch component is any commercially available starch. This may be derived from wheat, maize, potato, rice, oat, arrowroot, and pea sources.

Generally the water content is about 10 to 15 %. A preferred concentration range for starch is 50 to 70.6%

The polymer component c) of the composition is preferably compatible with starch, water soluble, biodegradable and has a low melting point compatible with the processing temperatures for starch. Polyvinyl alcohol is the preferred polymer but polymers of ethylene-vinyl alcohol, ethylene vinyl acetate or blends with polyvinyl alcohol may be used. A preferred concentration range for sheet material is 7 to 9%.

The preferred plasticiser is glycerol although ethylene glycol and diethylene glycol are also suitable as is sorbitol. Cost and food contact are important issues in choosing the appropriate plasticizer. For low humidity environments such as biscuit packages it has been found that lower plasticizer content improves the toughness and long term resilience of the material. This is partly due to the properties of the starch ether component and the fact that at low humidity plasticizers such as glycerol tend to remove water from the starch polymer and make it more brittle. It is possible to process the formulation with no plasticizer and the rigid polymer formed is flexible and has good impact resistance at low humidity. When the plasticiser content is low additional water is added to improve processing. Thus the plasticizer content is preferably 0 to 12% and the water content is 12 to 0%. For film processing the plasticizer content is preferably higher than for rigid sheet products. Higher concentrations of plasticiser improve flexibility and for flexible packaging films or mulch films the preferred plasticiser content is 10 to 16%.

The fatty acid or fatty acid salt component is preferably present in concentrations of 0.6 to 1%. Stearic acid is the preferred component. Sodium and potassium salts of stearic acid can also be used. Again cost can be a factor in the choice of this component but lauric, myristic, palmitic, linoleic and behenic acids are all suitable. It is found that the acid tends to accumulate near to the surface of the composition as it is extruded.

Detailed description of the invention

Processing conditions depend on the formulations and the desired properties of the product to be produced. The materials need to be heated above 140 °C in the

extruder to fully gelatinise the starches. The die temperature needs to be controlled below 110 °C to avoid foaming.

The preferred method of carrying out this invention involves mixing the starch, modified starch, vinylalcohol polymer lubricant and fatty acid components into a free flowing powder. The premixing can be carried out in any conventional mixer. The powder is then introduced into a screw extruder and subjected to an elevated temperature by the shearing action of the screw and the application of external heat to the barrel. The temperature is raised to a maximum in the range of 130°C to 160 °C. Any liquid components including additional water are introduced during this initial phase. The melt that is formed is then propelled toward the die and in moving forward the temperature is reduced to a value in the range of 85 °C to 105°C.

A typical extrusion for rigid products has the following parameters:

Temperature profile °C : 60, 70, 90, 110, 130, 145, 130, 120, 110

Screw Speed 120 rpm

Die Pressure 1400 psi

Flexible film can be formed by simply extruding from a sheet forming die and then increasing the speed of the take-off roller to achieve the reduced thickness needed for flexible film. Cooling of the film between the die and the roller is usually needed to ensure that the film does not adhere to the roller. De-humidified air to cool the film also assists in removing excess moisture from the film surface. If the film is formed by the blown tube method dehumidified air is used to blow the film as it exits the die. Talc may also be entrained in the air stream to reduce blocking of the film.

Examples 1-14

Biscuit trays were made by extruding a sheet and subsequently thermo forming the tray in a hot press. A twin screw extruder was used with a screw speed of 130rpm.

The barrel temperature profile was 95 [die], 95 [adapter], 95, 95, 95, 95, 100, 130, 140, 150, 140, 110, 90, 60. The process avoided foaming at the die and did not require venting of the barrel to remove moisture.

The formulations and the initial observations of the trays' performance are given in the table 1.

More detailed tests were carried out on sheets made from examples 9 to 14 and these results are shown in tables 2, 3 & 4.

TABLE 1

Example	A939 [hydroxy propylated amylose]	Wheat Starch	PVOH	Glycerol	Stearic Acid	Remarks
1	37.46	37.46	8.1	14.29	0.84	Includes 4.02% talc no foam, fairly flexible, very strong
2	33.51	33.51	7.46	21.05	0.75	Includes 3.72% CaCO ₃ No foam, flexible, weak
3	34.42	34.42	7.66	18.92	0.77	Includes 3.81% CaCO ₃ slight foam, flexible, strong
4	35.38	35.38	7.88	16.67	0.79	Includes 3.92% CaCO ₃ slight foam, flexible, strong
5	37.34	37.34	7.87	16.67	0.78	no foam, flexible, strong
6	38.41	38.41	8.08	14.29	0.81	no foam, flexible, strong
7	39.71	39.71	8.03	11.76	0.79	no foam, flexible, very strong
8	38.03	38.03	7.69	11.27	0.76	Includes 4.23% water no foam, flexible, fairly strong
9	81	0	8	10.2	0.8	
10	65	16	8	10.2	0.8	
11	57	24	8	10.2	0.8	
12	24	57	8	10.2	0.8	
13	16	65	8	10.2	0.8	
14	0	81	8	10.2	0.8	

5

Table 2 - Youngs Modulus

example	initial	24 hours	1 week
9	942.591	355.992	395.783
10	743.174	611.025	459.516
11	729.490	578.648	567.977
12	905.406	609.926	600.324
13	1079.915	519.888	688.400
14	1155.357	797.400	749.335

Table 3 – Stress at 0.2% yield offset

C	initial	24 hours	1 week
9	9.522	2.189	3.413
10	6.016	4.144	3.078
11	7.313	3.823	4.102
12	7.929	3.814	5.695
13	12.624	5.178	6.263
14	14.175	6.884	6.565

Table 4 - % strain at the breaking point

C	initial	24 hours	1 week
9	56.969	82.532	78.304
10	49.845	43.613	41.588
11	56.550	56.166	37.591
12	19.188	47.033	21.798
13	17.699	40.952	21.165
14	8.552	27.661	16.145

From the above tests and examples and based on cost considerations a suitable formulation for this biscuit tray application is:

A939 [hydroxy propylated amylose]	Wheat Starch	PVOH	Glycerol	Stearic Acid
15	65.2	8	11	0.8

- 10 The trays are biodegradable and have strength and flexibility properties comparable to the non biodegradable materials currently used. The costs of production are also comparable.

Examples 15 - 22

The effect of stearic acid content on the composition was tested using a formulation of :

	Wheat starch	36%
5	Modified Amylose A939	36%
	Polyvinyl alcohol	8%
	Glycerol	10%
	Water	10%

- 10 The mixture was processed at a feed rate of 1.5 a screw speed of 100 rpm and the temperature profile was 70, 90, 100, 130, 140, 140, 130, 115, 110, 110, 110[die]

Example	Stearic acid content [%]	Torque [%]	Mass [g/min]	Quality of Sheet [observation]
15	0.0	57	101	Rough surface
16	0.4	51	100	Nice sheet
17	0.8	44	106	Nice sheet
18	1.2	39	114	Nice sheet
19	2	38	106	Sheet with some holes
20	3	38	106	Sheet with holes
21	4	35	101	Sheet with a lot of holes
22	5	34	102	Sheet with a lot of holes

The results show that torque is decreased with increase in stearic acid content.

- 15 Output mass peaks at a stearic acid content of 1.2 g. the preferred range of stearic acid is 0.4 to 1.5 %.

Examples 23-26

The following four formulations have also been found suitable for use in forming packaging trays for foodstuffs such as chocolates and biscuits.

Materials	Example 23	Example 24	Example 25	Example 26
A939	39.5	39.5	79	79
Wheat starch	39.5	39.5	0	0
PVOH	8	8	8	8
Stearic acid	1	1	1	1
Glycerol	6	3	6	3
Water	8	10	8	10

EXAMPLE 27

Formulations as shown in table 5 were prepared for the purpose of assessing their performance under low and high humidity conditions and to assess the performance of the plasticiser under these conditions.

Table 5

Materials	A939 %	PVOH %	Stearic acid %	Water %	Glycerol %
A	79.5	7.95	0.8	0	11.75
B	78.31	7.84	0.8	4.35	8.7
C	78.31	7.84	0.8	7.25	5.8
D	78.31	7.84	0.8	10.15	2.9
E	79.5	7.95	0.8	11.75	0

Table 6 shows the strength characteristics at 65% RH and table 7 shows the characteristics at 15% RH for these formulations.

Table 6 – 65%RH

Formulation	Modulus [Mpa]	Yield S. [Mpa]	Elongation %
A	547	3.2	118
B	774	7.1	78
C	1080	14	65
D	1556	18	40
E	1832	27	28

Table 7 – 15%RH

Formulation	Modulus [Mpa]	Yield S. [Mpa]	Elongation %
A	1750	27	20
B	1916	33	26
C	2035	33	23
D	2447	38	24
E	2696	41	23

Tables 6 and 7 show that under high or medium relative humidity Glycerol improves toughness as measured by elongation. Under low relative humidity the glycerol absorbs water from the starch in the polymer and this decreases toughness.

Example 28

Two formulations were prepared on being formula E of example 27 and the other being the same except that 50 % of the A939 was replaced by wheat starch. Both formulas were processed extruded as sheet and then thermoformed into biscuit trays. The trays were used in a product trial where biscuits were placed in the tray packaged and then stored for three months. The performance and appearance of the trays were acceptable and as good as conventional non – biodegradable trays. The significant advantage of the trays made by both formulations were that disposal was much simpler. Conventional trays are difficult for consumers to

compress and their volume cannot be significantly reduced but by simply running these trays under a tap they can be compressed by hand into a small disposable pellet.

- 5 From the above description and examples it can be seen that the present invention provides a biodegradable starch polymer that is comparable in price and performance characteristics to conventional non-biodegradable polymers. Consequently packaging of products such as biscuits and chocolates using a rigid thermoformed tray can be just as presentable and attractive with the added benefit
- 10 of being environmentally friendly. Similarly packaging of products such as bread, in flexible packaging films, can also be attractive and biodegradable.

CLAIMS

1. A biodegradable polymer having the composition

a) from 8 to 80% by weight of a starch modified to include an

hydroxyalkyl C₂₋₆ group or modified by reaction with an anhydride of a di-

carboxylic acid

b) from 0 to 87.9% of starch

c) from 4 to 11% by weight of a water soluble polymer selected from

polyvinylacetate, polyvinyl alcohol and copolymers of ethylene and vinyl alcohol
which have a melting point compatible with the molten state of the starch

components

d) from 0 to 20% by weight of a polyol plasticiser

e) from 0.1 to 1.5 % by weight of a C₁₂₋₂₂ fatty acid or salt and

f) from 0 to 12% by weight of added water.

2. A composition as claimed in claim 1 wherein component e) is stearic acid.

3. A composition as claimed in claim 1 or claim 2 wherein component c) is a
polyvinyl alcohol component.

4. A composition as claimed claim 1 wherein the polyol plasticiser is glycerol.

5. A composition as claimed in claim 1 wherein the polymer is thermoformable
into rigid packaging products and the polyol plasticiser content is less than
11%.

6. A composition as claimed claim 5 wherein the polyol plasticiser content is zero
and added water is from 10 to 12 %.

7. A composition as claimed in claim 1 wherein the polymer contains 10 to 16% of
plasticiser and is formed into a flexible film.

8. A composition as claimed claim 7 wherein the water content is zero.

9. A process for forming starch polymer products which includes the steps of
- a) forming a mixture of starch, a modified starch, a water soluble polymer or
5 copolymer containing vinyl alcohol units, up to 20 % of added water and/or a
polyol plasticizer and 0.4 to 1.5 % by weight of a C₁₂₋₂₂ fatty acid or salt and
 - b) working the mixture and forming a melt within the temperature range of 130°C
to 160 °C
 - c) reducing the temperature and further working the mixture and then extruding
10 the mixture or injecting the mixture into a mould at a temperature of 85 °C to
105 °C without the need to remove water.
10. A process for forming starch polymer products as claimed in claim 9 wherein
the polymer is extruded into a sheet and subsequently thermoformed into a
15 packaging tray.

T 000000-1194500

DECLARATION FOR PATENT APPLICATION

As a below-named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

the specification of which: Biodegradable Polymer (check one)

☐ is attached hereto ☐ was filed on 13 December 1999, as United States Patent Application Serial No. or PCT International Application Number PCT/AU99/01101, and was amended on _____ (if applicable)

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the patentability of this application in accordance with 37 CFR § 1.56(a)

Prior Foreign Application(s). I hereby claim foreign priority benefits under 35 U.S.C. § 119(a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate listed below, or § 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Application No.	Country	Filing Date	Priority Claimed
PP 7696	AUSTRALIA	14/12/98	<input type="checkbox"/> <input type="checkbox"/>
PP 7697 (Application No.)	AUSTRALIA (Country)	14/12/98 (Day/Month/Year Filed)	Yes No
PP 7702	AUSTRALIA	14/12/98	<input type="checkbox"/> <input type="checkbox"/>
PQ 1847 (Application No.)	AUSTRALIA (Country)	27/07/99 (Day/Month/Year Filed)	Yes No
(Application No.)	(Country)	(Day/Month/Year Filed)	<input type="checkbox"/> <input type="checkbox"/>
			Yes No

I hereby claim the benefit under Title 35, United States Code § 119(e) of any United States provisional application(s) listed below:

Application No.

Filing Date

I hereby claim the benefit under 35 U.S.C. § 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by 35 U.S.C. § 112, first paragraph, I acknowledge the duty to disclose material information as defined in 37 CFR § 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

(U.S. Application Serial No.)	(U.S. Filing Date)	(Status--patented, pending, abandoned)
(U.S. Application Serial No.)	(U.S. Filing Date)	(Status--patented, pending, abandoned)

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. § 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon

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DECLARATION FOR PATENT APPLICATION

Page Two

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